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The Amount of Prenatal Care in Women Thirty-five Years and Older and It's Effects on Birth Weight, Gestational Age and Apgar Scores

By

Amy Moe

Thesis Submitted in Partial Fulfillment

of the Requirements for the Degree

of Master of Science

Physician Assistant Studies

Augsburg College

May 2004

MASTER OF SCIENCE IN PHYSICIAN ASSISTANT STUDIES
AUGSBURG COLLEGE
MINNEAPOLIS, MN

CERTIFICATE OF APPROVAL

This is to certify that the Master's Thesis of

Amy L. Moe

has been approved by the Thesis Review Committee for the Master of Science in Physician Assistant Studies degree

Date of Oral Defense: March 24, 2004

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DEDICATION

I would like to dedicate this project to my family.
I would not be where I am today without the support
of each and every one of you.
I love you all.

ABSTRACT

Background

Prenatal care is essential to the health of mothers and their babies. It is unclear what aspects of prenatal care influence maternal and infant health the most. The purpose of this study was to determine if the amount of prenatal care visits a woman thirty-five years or older receives impacts the newborn's health.

Methods

The medical records of all women thirty-five years of age and older who gave birth at Cambridge Allina Medical Center in a one-year period were reviewed. The number of prenatal care visits for each subject was correlated with the birth weight, gestational age and Apgar scores of her infant.

Results

A positive correlation was determined between increasing birth weight and amount of prenatal visits, increasing gestational age and amount of prenatal visits, and increasing Apgar scores and amount of prenatal visits. However, these correlations were found to not be statistically significant using a $p < 0.05$.

Conclusions

It is not clear how big of an impact the amount of prenatal care visits has on birth outcomes. Further research with a larger and more diverse population should be done to determine how strong of a connection there is between prenatal care and birth weight, gestational age and Apgar scores.

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CHAPTER ONE: INTRODUCTION

Prenatal care is essential to the health of mothers and their babies. It leads to improved maternal health and pregnancy outcome, and it provides an opportunity for health care providers to evaluate and address issues related to general health for which women may not otherwise seek care (Krueger & Scholl, 2000). Prenatal care received early in pregnancy is important to a mother's health as well as the health of her child (U.S. Department of Health and Human Services, 1992). What is not clear are the aspects of prenatal care that influence maternal and infant health the most (McDuffie, Beck, Bischoff, Cross, & Orleans, 1996). It is imperative to understand what elements of prenatal care are important so that women can be fully educated and make informed choices about health care during pregnancy.

Background to the Study

Healthy People 2000 is a compilation of national objectives on health promotion and disease prevention that is published and updated approximately every ten years by the U. S. Department of Health and Human Services. The purpose is to challenge the people of the United States to use their resources effectively and improve the health of the nation. Children are important to the future of our nation. Without a new generation to replace the previous one, a nation would cease to exist. Poor birth outcomes translate into higher infant mortality rates and impaired children, which impact a nation by decreasing the size of each new generation and thus opportunities for the future. In 1992, information relating to the health of mothers and children was collected from *Healthy People 2000* and expanded to create *Healthy Children 2000* (U. S. Department of Health and Human Services, 1992).

One of the key goals of *Healthy Children 2000* was to reduce the infant mortality rate from 10.1 per 1,000 live births to 7 per 1,000 live births (U.S. Department of Health and Human Services, 1992). Even though there were improvements in some aspects that contribute to infant mortality between 1987 and 1997, more progress needs to be made in specific areas. Advances in neonatal care have decreased the mortality rate during the first 28 days of life. However, low birth weight and pre-term birth are major contributors to infant mortality and morbidity overall, and the percentage of low birth weight babies born between 1987 and 1998 increased by 10 percent. The rate of low birth weight among African-American women showed the largest increase, and it is believed to be due to a younger maternal age, less education and inadequate prenatal care in that population (U.S. Department of Health and Human Services, 2000).

Low birth weight has been associated with an increased risk of mortality, and, for infants that do survive an increased chance of health problems and developmental disabilities (Avchen, Scott, Mason, 2000). In the study by Avchen, Scott, and Mason, the rate at which a disability occurred tripled from 146/1,000 live births to 449/1,000 live births as the birth weights dropped from 3500 – 3999 grams to less than 999 grams. Prematurity has also been associated with twice the risk for mortality and morbidity (Cano, Fons, Brines, 2001).

Apgar scores are used to measure the child's physical condition immediately after birth. These scores provide health care providers with a quick assessment of the health of the infant. A score of under seven at five minutes and longer after birth has also been associated with an increased risk of mortality and morbidity, especially neurologic injury (Thorngren-Jerneck, Herbst, 2001).

The new goals for *Healthy People 2010* reflect the continuing need for improvement in pregnancy outcomes and infant mortality and morbidity. To further reduce the number of deaths in infancy, women and their health care providers need to work together to modify the factors that contribute to that negative outcome. Prenatal care, including risk assessment for potential health problems of the mother and child, identifies behaviors and lifestyles that may contribute to poor pregnancy outcomes (U.S. Department of Health and Human Services, 2000). Even though studies have shown that "the presence or absence of early and adequate prenatal care is strongly related to pregnancy outcome" (Ryan, Sweeney, & Solola, 1980, p. 881), it is still unclear what aspects of prenatal care are most important in influencing that outcome (McDuffie, et al, 1996). It would be useful for health care providers to determine if there are an appropriate number of prenatal prenatal visits a woman should have to help insure the health of her newborn.

Statement of the Problem

The focus of this study was to determine if there was a correlation between the number of prenatal visits and pregnancy outcome, specifically the outcome of the fetus. Data on birth weight, gestational age and apgar scores was gathered as measurements of fetal outcome. Health care practitioners regularly use these measurements to assess the health status of the newborn.

Women aged thirty-five and older were targeted in this study because they have an increased risk for poor pregnancy outcomes and complications (Prysak, Lorenz, & Kisly, 1995; Seoud, Nassar, Usta, Melhem, Kazma, & Khalil, 2002). They tend to have higher incidences of gestational diabetes, preeclampsia and chronic hypertension. These

prenatal complications lead to more preterm births and cesarean sections. This group of women has not been the focus of many studies related to prenatal care in the past. Therefore, the topic of this study was to determine if the amount of prenatal visits received by a woman thirty-five years of age or older had an effect on her infant's birth weight, gestational age and Apgar scores at one and five minutes.

Purpose of the Study

The purpose of this study was to determine if the amount of prenatal care a woman thirty-five years or older receives impacts the newborn's health. This information is helpful for health care providers to determine what type of schedule should be recommended to obstetric patients. Women who are planning to conceive or who are already pregnant will benefit from knowing what they can do to influence their experience. The conclusions of the study could also lend support to the claim that prenatal care is an important factor in successful pregnancy outcomes. Older women have not traditionally been the sole focus of many studies in the past regarding prenatal care. Therefore, this study attempted to determine if the pregnancy outcomes for these women were related to the number of prenatal visits they received.

Research Question

The research question to be answered was:

> Does the amount of prenatal care received by women thirty-five years of age and older affect the infant's birth weight, gestational age and Apgar scores?

Definition of Terms

Amount of Prenatal Care – The actual number of visits a woman has with her health care provider relating to pregnancy and labor prior to the delivery of her child. Prenatal care

involves regular monitoring of all aspects of the pregnancy to assess the health of both the fetus and the mother. Each visit includes reviewing the history, a physical examination, any laboratory tests necessary, anticipatory guidance, and discussions involving patient education and questions or concerns of the woman.

Apgar Scores – A system for evaluating an infant's physical condition at birth. The infant's heart rate, respiration, muscle tone, response to stimuli, and color are rated at one minute, and again at five minutes after birth. Each factor is given a score of 0, 1 or 2, with a maximum total score of 10. A score of 7 to 10 is good to excellent; a score of 4 to 6 is fair; a score of less than 4 is poor (Venes, 2001).

Birth Weight – The weight of the newborn. Normal weight of the newborn is between 5.5 pounds (2.5 kilograms) and 10 pounds (4.5 kilograms).

Gestational Age – The length of time from conception to birth, measured in weeks.

Neonatal Period – The period of the first 28 days of life.

Prematurity – The state of an infant born any time prior to completion of the 37th week of gestation.

Term Birth – The state of an infant born after the normal duration of pregnancy, generally nine calendar months or 38 to 42 weeks.

Assumptions and Limitations of the Study

A limitation of this study is that it did not determine what is included in each prenatal visit or the length of each visit. Not all visits can be assumed to be equal in length or content. A woman who has eight prenatal visits may spend as much time with her provider and cover the same information as a woman who has ten visits.

Another limitation of this study involved the population that was chosen. Older women, because of their increased age, are at a higher risk for more serious complications. The increased potential for a poor outcome may not be influenced at all by prenatal care simply because the problems are irreversible regardless of what is done after conception.

A final limitation involving the population that was chosen was the lack of diversity among the subjects. The participants were all from the same small, rural community. They shared similar socioeconomic backgrounds. The results of the study cannot be generalized to other populations that include varied socioeconomic classes.

Summary

The purpose of this study was to determine if the amount of prenatal care a woman thirty-five years or older receives impacts the newborn's health. The most recent pertinent literature involving prenatal care and newborn health was reviewed and a retrospective chart review of women thirty-five years and older who gave birth in a small hospital in Minnesota was then performed to determine if the amount of prenatal care these subjects received had an impact on their infant's health at birth, as measured by birth weight, gestational age, and Apgar scores. The data was analyzed and conclusions were drawn from the results of the analysis. Recommendations for further research were also discussed.

CHAPTER TWO: LITERATURE REVIEW

Introduction

Numerous studies have been conducted on the subjects of prenatal care, pregnancy outcomes and measurements of newborn health. This chapter examines the current literature of how those measurements of pregnancy outcome and infant health relate to prenatal care. The three measurements discussed are birth weight, gestational age and Apgar scores at one and five minutes after birth. The findings from specific studies that relate prenatal care to those measurements are then separated into two categories: all mothers overall and low-income mothers.

Birth Weight

The weight of an infant at birth has been determined to be an important indicator of that infant's health and future quality of life. A study by Williams and Chen (1982) looked at the relationship between birth weight and neonatal mortality. They looked at the mortality rates of infants within a 17-year period in the state of California. The largest rate of decline in the mortality rate from 1960 to 1977 was among the infants weighing greater than 4500 grams, while the slowest rate of decline during that same time period was among the infants weighing below 1001 grams. The researchers concluded that a strong correlation existed between low birth weight and low rates of survival in the newborn.

Healthy People 2000 is a publication of the U.S. Department of Health and Human Services that outlines current health promotion and disease prevention goals for Americans, and it is updated approximately every ten years. Maternal and child health is

an important focus of Healthy People because "the future of our Nation is so closely tied to the health of our children" (U.S. Department of Health and Human Services, 1992, Introduction Letter). It has been established that as birth weight decreases, the incidence of disabilities such as cerebral palsy, blindness and seizure disorders increase. Therefore, included as one of the goals for Americans in *Healthy People 2010*, the current edition of *Healthy People 2000*, was to reduce the incidence of low birth weight from its current rate of 7.6 percent of all live births in the United States to 5.0 percent. Average hospital costs for a child with a low birth weight amount to about $6,200, and those for a child of normal weight average about $1,900. Reducing the incidence of low birth weight by even a few percent can reduce hospital costs by a large amount (U.S. Department of Health and Human Services, 2000).

Two studies showed a correlation between low birth weight and delays in childhood development. A longitudinal study by Taylor, Klein and Hack (2000) compared normal birth weight controls to their low birth weight cohort. The researchers followed the children through their school years. They looked at health and growth status, neuropsychological and achievement tests, measures of behavior and school performance provided by the teachers and parents, and educational placements and modifications needed. From the data collected, the researchers concluded that very low birth weight was linked to an increasing number of health problems and developmental difficulties. These difficulties involve cognitive function, achievement and behavior. Impairment in these areas begins in early childhood and continues over the school-age years. Avchen, Scott, and Mason (2001) also followed a group of infants through their school-aged years and determined that the level of an infant's future disability increased

as birth weight decreases, with the greatest risk of delays being in cognitive and motor development.

The Archives of Pediatrics & Adolescent Medicine published a study that examined family outcomes of children that were of very low birth weight (Taylor, Klein, Minich & Hack, 2001). The study confirmed earlier reports of high instances of adverse family outcomes and increased levels of dysfunction in the neonatal and early childhood years. Researchers also determined that the effects persisted well into the later childhood and adolescent years. Most children with low birth weights have continual health problems related to their low birth weight, and parents report higher levels of stress, more difficulty attaching to the child and more feelings of incompetence at parenting.

The previous studies discussed all support the use of birth weight as a valid predictor of an infant's immediate and future health and development. Low birth weight is associated with negative outcomes. Therefore, it is beneficial to determine the influence(s) on an infant's birth weight so that the incidence of low birth weight can be reduced. The current study looked at prenatal care and its effects on birth weight.

Gestational Age

Prematurity, defined as a gestational age of less than thirty-seven weeks, has been a topic of interest for researchers. Many studies have examined the level of prematurity and its relationship to morbidity and mortality. Cano, Fons, and Brines (2001) determined that the most important reason for increased mortality in preterm infants was their developmental immaturity - they were not able to completely adapt to the environment outside the uterus. Therefore, as gestational age decreases, less adaptation

is able to take place and more problems arise. Immaturity continues to be the main reason for infant mortality during the neonatal period.

A study published in the Journal of Pediatrics in 2001 looked at the correlation between prematurity and birth defects (Rasmussen, Moore, Paulozzi, & Rhodenhiser). It was determined that there was a significant risk for birth defects, such as cardiac defects and gastrointestinal problems like small intestinal atresia, gastroschisis, and esophageal atresia, in infants born before thirty-seven weeks of age. Birth defects such as these can lead to poor growth and development. The risk increases as the gestational age decreases. In fact, researchers found evidence that the risk of death from these same birth defects may increase as gestational age decreases.

Problems in long-term cognitive development and behavior abilities have also been linked to prematurity. Impairment in the development of cognitive skills and disabilities related to academic achievement, psychomotor skills and visual memory were confirmed by studies of school-aged children who were born premature (Wolke & Meyer, 1999; Waber & McCormick, 1995). Impairments such as reduced IQ and academic achievement, visual memory, and fine neuromotor control appeared up to 25% more frequently in premature infants as compared to full-term infants. Behavior problems related to social competence, attention and temperament are also associated with prematurity (Chapieski & Evankovich, 1997). Children that are born premature tend to face more challenges in school and in their lives. These challenges make it harder for them to fit in and to be accepted by their peers and by society.

Gestational age has been shown to play an important role in an infant's health and development. Specifically, gestational age associated with prematurity has been linked to

increased morbidity and mortality. It is important to understand the influences on prematurity. The current study examined the correlation between prenatal care and gestational age.

Apgar Scores

Assessment of an infant at birth is a key function in determining if any intervention or special care is needed. In 1952, Virginia Apgar looked at ways to assess compromise in the newborn. She wanted to determine how to evaluate birth asphyxia, an inadequate intake of oxygen that leads to compromise. She determined that heart rate, respiratory effort, muscle tone, reflex irritability and color were easily identifiable and important measurements of compromise. She then developed a scoring system that evaluated and assigned a number to each of those five characteristics relating to the physical condition of an infant at one and five minutes after birth. These scores are known as Apgar scores (Apgar, 1953). A study by Casey, McIntire, and Leveno, in 2001, confirmed, "the Apgar system continues to be relevant to the prediction of neonatal outcome after almost half a century" (p. 471). They found that the risk of neonatal death increases as the Apgar score (especially at five minutes) decreases. The features of vital activity that the Apgar score measures reflects the prognosis for neonatal survival.

Many studies concur that low Apgar scores are associated with increasing perinatal morbidity and mortality. A study published in Obstetrics and Gynecology reported that low five-minute scores were linked to an increased risk of infant mortality and neurologic problems, such as cerebral palsy, epilepsy and mental retardation (Thorngren-Jerneck & Herbst, 2001). The European Journal of Epidemiology reported that persistently low Apgar scores were associated with congenital abnormalities,

cerebral palsy and future intellectual difficulties (Jonas, Chan, Macharper & Roder, 1990). Misra, et al. (1994), determined that a poor neurodevelopmental outcome is related to low Apgar scores, especially if the score shows no improvement after five and ten minutes. The researchers from these studies agree that Apgar scores are valid predictors of potential hypoxia, and hypoxia is what leads to some complications in the newborn.

Apgar scores have been determined to be a valuable measurement of neonatal morbidity and mortality. They are important indicators of potential difficulties that an infant may experience. Improving Apgar scores has the potential to decrease the incidence of those difficulties. The current study looked at the potential effects of prenatal care on Apgar scores.

Prenatal Care Received by All Women

Much research in the past has examined prenatal care and its effects on infant mortality. A study performed in 1979, by Steven Gortmaker, looked at prenatal care and its effects on neonatal and post neonatal mortality. Upon analysis of the data that he collected, Gortmaker determined that the adequacy of prenatal care (defined in terms of timing and quantity of prenatal visits, adjusted for gestation length) had little direct effect on the rate of infant mortality, but it does increase the risk of low birth weight. Thus, "if prenatal care exerts any effects upon infant mortality, it is likely that these effects occur via the relationship of prenatal care to low birth weight" (p. 656). This study helped focus future research on measurements of the newborn that influence mortality, including low birth weight.

Many studies since 1979 have compared birth weights and gestational ages to prenatal care. In 1987, Greg Alexander and Donald Cornely looked at infant birth and death records in South Carolina during the period of 1978 – 1982. They classified prenatal care utilization into categories of intensive, adequate, intermediate, inadequate or no care by considering the number of visits, the month in which care was initiated, and gestational age. They then compared the utilization categories with the infants' birth weights, gestational ages and rates of mortality. The results showed that the inadequate and no care groups produced infants with smaller birth weight and higher percentages of preterm births. The lowest birth weights and highest percentage of preterm infants are seen in the no care group (Alexander & Cornely, 1987). In 1991, Alexander, along with another group of researchers, duplicated his previous study on another set of women that were divided into the same categories (Hulsey, Patrick, Alexander, & Ebeling). He reached similar conclusions as in his 1987 study. The results support the theory that prenatal care has benefits on pregnancy outcome.

A number of other studies have come to similar conclusions. A study conducted in Israel in 1986 found that prenatal care greatly influenced pregnancy outcome (Insler, et al.). "The incidences of low birthweight and of extreme prematurity were inversely proportional to the intensity of prenatal care" (p. 221). The number of visits determines intensity, with one to six visits being rudimentary, seven to ten visits being average and over ten visits being adequate. Two other studies also determined that lighter babies are born to women with less than adequate (three or less visits) or absent prenatal care (Ryan, et al, 1980; Mustard & Roos, 1994).

A few studies have included in their research the relationship of prenatal care to Apgar scores. One study concluded that Apgar scores that were below seven (out of a total of ten possible points) at five minutes were consistently associated with less than seven prenatal visits by the mother (Jonas, Chan, Macharper & Roder, 1990). Sixteen percent of babies whose mothers had fewer than seven visits had an Apgar score of less than seven at five minutes, as compared with 8.5 percent of babies whose mothers had greater than seven visits. A second study determined that there is an increased incidence of low Apgar scores with a declining number of prenatal visits (Insler, et al., 1986). The researchers concluded that poor physical condition at birth, as measured by the Apgar score, is related to less intense prenatal care, defined as less than seven visits.

Not all research resulted in the same conclusions as the previous studies. A Finnish study in 1994 determined that increasing amounts of prenatal care did not always improve the pregnancy outcome (Gissler & Hemminki). The study looked at prematurity, low birth weight and Apgar scores in relation to prenatal care. Women who have an average number of visits (approximately twelve) have better outcomes than those who had few or no visits, but that trend does not continue as the number of visits increases. Women who have many visits (greater than twelve) tend to have the worst outcomes. There is a slightly higher incidence of perinatal infant mortality, gestation periods are shorter, and more babies are born at a low birth weight. The researchers suggested that this trend might be related to the reasons why a woman seeks prenatal care. If a woman has had problems with previous pregnancies, anticipates or develops problems or concerns in her current pregnancy, she may seek out care earlier than a

woman with no previous issues. Therefore, these women may already be at a higher risk for a negative perinatal outcome (Gissler & Hemminki, 1994).

A study done in Colorado in 1996 looked at the effect of lowering the recommended amount of prenatal care visits for women at low risk for poor outcomes (McDuffie, et al). Women determined to be at low risk did not have a current medical condition requiring treatment; they had no history of an ongoing illness, such as diabetes, chemical abuse, or chronic hypertension; they had no history of previous high-risk pregnancies; and they were currently not considered to have a high-risk condition, such as multiple gestation or a leiomyomata greater than four centimeters. The researchers wanted to determine if there was an impact on neonatal outcome if the schedule of fourteen visits endorsed by the American College of Obstetricians and Gynecologists was lessened to nine visits. The results showed that there were no differences in outcomes among the infants included in the study. The conclusions were that positive pregnancy outcome can be achieved with a slight reduction in number of visits in low-risk women.

Lack of prenatal care was the focus of a study done in Israel in 2001 (Twizer, Sheiner, Hallak, Mazor, Katz and Shoham-Vardi). Researchers compared birth outcomes between mothers who had no prenatal care and mothers who had at least three prenatal care visits. They determined that the number of low birth weight and preterm babies was higher in the group with no prenatal care. However, they determined that there was no appreciable difference in the amount of birth defects and the Apgar scores at one and five minutes between the two groups. They concluded that lack of prenatal care contributed to low birth weight and preterm delivery, but they could not account for the lack of a difference in Apgar scores and amount of birth defects.

The above studies all analyze prenatal care and its effects on infant morbidity and mortality, as defined by at least one of the following measurements of pregnancy outcome: birth weight, gestational age or level of prematurity, and Apgar score. However, they lack a consistent conclusion as to what those effects are. Most of the studies suggest that further research needs to be done. The current study attempted to determine if the amount of prenatal visits was important to the pregnancy outcomes of women thirty-five and over. By limiting the study to one aspect of prenatal care and a smaller population, the results may be valid and applicable to other similar populations.

Prenatal Care Received by Women of Low Socio-Economic Status

Women of low socio-economic status are at an increased risk for having premature infants and infants of low birth weight (Verrier, Ying, Spears & Kerr, 1993). Studies have been done in the past looking at prenatal care received by low-income women and its effect on pregnancy outcome. The results have been mixed. Some studies determined that a number of measurements of infant outcome were worse as the amount of prenatal care in low-income women progressed from adequate to inadequate to absent (Showstack, Budetti, & Minkler, 1984; Verrier, et al, 1993; and Amini, Catalano, & Mann, 1996). Prenatal care was measured by the Kessner Index, which is based on the trimester of the first prenatal visit and the total number of prenatal visits for the period of gestation. The measurements of infant outcome included birth weight, gestational age, Apgar scores, admission to the neonatal intensive care unit and the length of the hospital stay of the infant.

The results of two other studies agreed with the above results that the amount of prenatal care had an affect on infant outcome. However, the researchers claim that the

only real difference in the measurements occurs between the groups that receive no care as compared with the groups that receive at least one visit. They determined that even minimal care seemed to decrease the risk of low birth weight and prematurity in low-income women (Poland, Ager, & Sokol, 1991; Ural, Blakemore, Pressman, Duhl, & Bienstock, 2000).

As demonstrated before, the studies from the literature in this section lacked a consistent conclusion to their research. It is still not clear how much prenatal care is sufficient to ensure a good pregnancy outcome for these subjects with a greater potential for problems in pregnancy.

Women of low socioeconomic status have been singled out as topics of research in this area because of their higher risk for difficulties in pregnancy and poorer pregnancy outcomes. The current study attempted to develop a correlation between the amount of prenatal visits and birth weight, gestational age and Apgar scores, using another high risk group of women who have not been the focus of research on this topic.

Prenatal Care Received by Women Aged Thirty-five Years and Older

Women aged thirty-five years and older are at an increased risk for prematurity and perinatal morbidity and mortality (Scholz, Hass, & Petru, 1999). They tend to be at a higher risk due to a higher incidence of serious medical or surgical disorders, treatment for infertility, and problems with preeclampsia. The effects of prenatal care on the pregnancy outcomes of this population have not been the focus of much research in the past. Many studies separate the mothers into age groups, but they do not specifically analyze the effects of prenatal care received on the pregnancy outcomes in the older categories of women. Prenatal care and its effects on the pregnancy outcomes of

adolescent mothers have been studied (Scholl, Miller, Salmon, Cofsky, Shearer, 1987). However, there have been no studies where mothers aged thirty-five years and older have been the primary focus of the research.

Summary

The above studies demonstrate a lack of consistency in results in the answer to the question of whether the amount of prenatal care affects birth weight, gestational age and Apgar scores. It could be that there is no relationship between the amount of prenatal care and birth outcomes. However, in specific populations of women, the amount of prenatal care might have an impact of outcome. Women thirty-five years of age and older, who are at increased risk for negative outcomes, may benefit from a certain amount of prenatal visits. Some of the studies looked at limited populations of women in a specific area, but many studies analyzed data from all women who gave birth in that area. Most of the researchers concluded that more exploration is necessary on the topic. The current study asked the same question in relation to the high risk group of women that are thirty-five years of age and older, a group who has typically not been the focus of previous studies.

CHAPTER THREE: METHODOLOGY

Description of Methodology

The type of research methodology used in this study was historical and descriptive. Subjects were chosen based on the specific criteria of the age of the mother at the time of her child's birth. Information was gathered from those subjects' past medical records. The data was analyzed and any correlations between the variables was extrapolated and described.

Design of Study

In this retrospective study, the medical charts of all women thirty-five years of age and older who gave birth at Cambridge Allina Medical Center from January 1, 2002 through December 31, 2002, were reviewed. A letter of permission was obtained prior to the chart review (see Appendix A). The staff in the medical records department ran a chart audit and selected charts for inclusion based on the subjects' age and the presence of a signed authorization for release of records for research purposes. Each chart that fit the criteria for inclusion in the study was reviewed by the researcher and the following information was gathered: the number of prenatal visits the mother attended, the trimester in which care was initiated, the birth weight and gestational age of her child, and the child's Apgar scores at one minute and five minutes. A data collection form was created to record the data for each subject (see Appendix B).

The number of prenatal care visits was compared to the gestational age and the trimester care was initiated. Then each amount was placed into one of the following categories: adequate care, intermediate care and inadequate care. These categories have been set up by the Institute of Medicine based on their definition of adequacy of prenatal

care (see Appendix C) (Kessner, Singer, Kalk & Schlesinger, 1973). The number and timing of visits and the length of the pregnancy are all taken into account so that the number of prenatal care visits between women can be accurately compared. For example, a woman that delivers prematurely may have the same number of prenatal visits as a woman who delivers on her due date but who initiated care later than the previous woman. Based on the Institute of Medicine definition that information would be evaluated and the data from these women would not be placed in the same category.

The independent variable in the study was the amount of prenatal care visits a woman attends. The dependent variables were birth weight, gestational age and Apgar scores at one and five minutes as they are the end points of the study. The study measured potential effects of the independent variable, the number of prenatal care visits, on the dependent variables, birth weight, gestational age and Apgar scores.

Sample and Population

There are approximately 500 births at the Cambridge Allina Medical Clinic during a given year. An estimated 12.5%, or approximately 40, of those women who give birth in Cambridge per year are thirty-five years or older. Medical records for women who gave birth between January 1, 2002, and December 31, 2002, were reviewed and those women who were at least thirty-five years old at the time of birth were selected for inclusion. Of those charts that were reviewed, only charts of subjects that had signed a release of medical records for research purposes were included in the study. A valid study requires at least one percent of the population, or at least 20 subjects, be included. If it had been necessary to find more subjects, the charts of patients who gave birth during the year 2001 would have been reviewed also.

Before the chart review could begin, it was necessary to gain approval from both the Allina Institutional Review Board (IRB) and the Augsburg Institutional Review Board (see Appendix D & E). The Allina IRB evaluates each potential study involving subjects from an Allina institution and determines whether that study can be performed. The Augsburg IRB does the same for each potential study performed by its students. The goal of both IRB's is to ensure the safety and confidentiality of each participant. In this study, the participants were never contacted in person, and no identifying information from the charts was reviewed or collected by the investigator of the study. Also, each subject had previously signed a release of medical records for research purposes. Based on that information the study was approved by both boards.

Instrumentation

The method of data retrieval was a retrospective chart review of prenatal and perinatal records for mothers that were thirty-five years and older at the time of their deliveries. The information gathered was similar to the information that was gathered in many previous studies looking at prenatal care and pregnancy outcomes, including those studies performed by Alexander and Cornely, in 1987, and Hulsey, Patrick, Alexander and Ebeling, in 1991.

Data Collection and Analysis

The data for the study was gathered from the medical records of women who fit the criteria for subjects of the study. After the subjects were determined, the records were reviewed for the data necessary for the study. Consistent information was documented from each chart reviewed, using the data collection form (see Appendix B): the number of prenatal visits the mother attended, the trimester in which care was

initiated, the birth weight and gestational age of the infant and the infant's Apgar scores at one and five minutes.

Ordinal and nominal data was gathered and basic descriptive statistics were used to analyze the data. Four t-test studies were run to look for significant differences in birth weight, gestational age and Apgar scores at one and five minutes as they related to the number of prenatal visits a woman attended. Correlation coefficients and confidence intervals were tabulated for each study, and these numbers expressed the magnitude and direction of the association between each of the two variables.

CHAPTER FOUR: RESULTS

Demographics

The number of women aged thirty-five years and older who gave birth at Cambridge Allina Medical Center between January 1, 2002, and December 31, 2002, was 46. Two women did not have a signed release of records for research purposes. Four women did not have complete records, as they had received prenatal care at other institutions prior to becoming patients at Cambridge Allina Medical Center. During the one year period, the total number of subjects that met the study criteria was 40. Of the 40 participants, 5 (12.5%) women delivered preterm (prior to the end of the 37th week of gestation) and 1 (2.5%) infant was born at a low birth weight (less than 5.5 pounds).

Prenatal Care

Thirty-one patients, or 77.5%, initiated prenatal care in the first trimester, as compared to 9 patients, or 22.5%, who initiated prenatal care in the second trimester. No patients initiated care after the second trimester. Table 1 shows the frequency and percent of prenatal visit amounts.

TABLE 1. AMOUNT OF PRENATAL CARE VISITS

Amount of Prenatal Visits	Frequency	Percent
3	1	2.5
7	2	5.0
8	4	10.0
9	2	5.0
10	6	15.0
11	3	7.5
12	9	22.5
13	9	22.5
14	2	5.0
15	2	5.0

The amount of prenatal visits for each patient was combined with the trimester in which she initiated care in and the gestational age of the baby to determine the adequacy of prenatal care visits, according to the categories set up by the Institute of Medicine in 1973 (see Appendix C) (Kessner, Singer, Kalk & Schlesinger). Of the 40 study subjects, 28 (70%) women had prenatal care that was classified as an adequate amount of visits, and 12 (30%) women had prenatal care that was classified as an intermediate amount of visits. None of the subjects had prenatal care that was classified as an inadequate amount of visits (see Appendix F).

Birth Weight, Gestational Age and Apgar Scores

Figure 1 shows mean birth weights for both prenatal care visit adequacy categories. The mean birth weight for the infants in the intermediate prenatal care visit group was 7.74 pounds with a standard deviation of 0.98 pounds, and the mean birth weight for the infants in the adequate prenatal care visit group was 7.66 pounds with a standard deviation of 1.70 pounds.

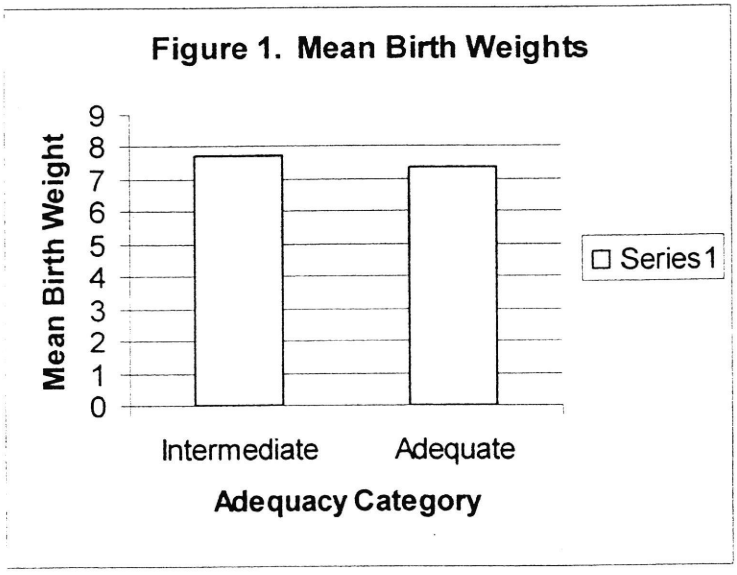


Figure 2 shows mean gestational ages for both prenatal care visit adequacy categories. The mean gestational age for the infants in the intermediate prenatal care visit group was 39.37 weeks with a standard deviation of 0.78 weeks, and the mean gestational age for the infants in the adequate prenatal care visit group was 38.84 weeks with a standard deviation of 3.58 weeks.

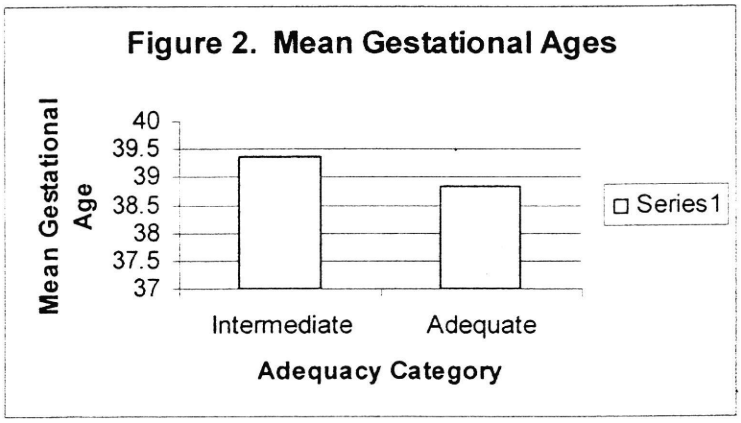
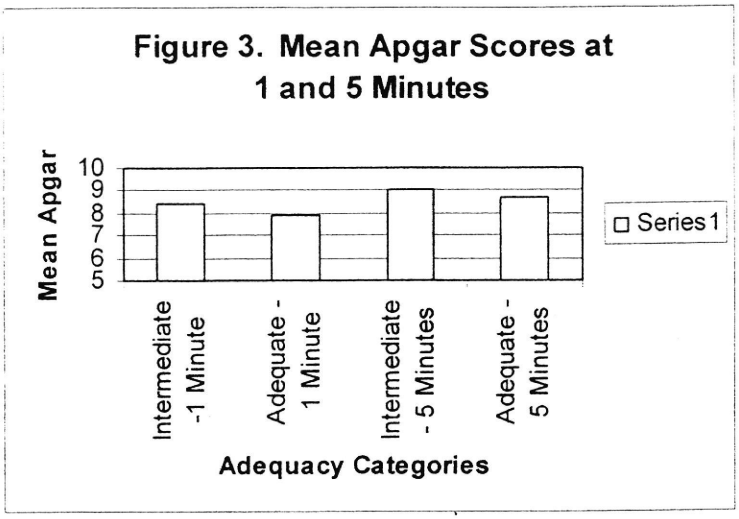


Figure 3 on the next page shows mean Apgar scores at 1 minute and 5 minutes for both prenatal care visit adequacy categories. The mean Apgar score at 1 minute for the infants in the intermediate prenatal care visit category was 8.42 with a standard deviation of 1.24, and the mean Apgar score at 1 minute for the infants in the adequate prenatal care visit category was 7.86 with a standard deviation of 1.67. The mean Apgar score at 5 minutes for the infants in the intermediate prenatal care visit category was 9.0 with a standard deviation of 0.43, and the mean Apgar score at 5 minutes for the infants in the adequate prenatal care visit category was 8.68 with a standard deviation of 1.54.



Correlations and Confidence Intervals

A correlation looks at what type of relationship exists between two or more variables. A correlation coefficient is a number that expresses the magnitude and direction of the relationship. If the correlation coefficient between two variables is positive, this means that as one variable increases, the other variable also increases (high scores of one variable are related to high scores of the other variable). If the correlation coefficient is negative, this means that as one variable increases, the other variable decreases (high scores of one variable are related to low scores of the other variable). A t-test is a statistical test that is used to determine the correlation coefficient when the sample size is small. The higher the correlation is, the greater the reliability and predictive value of the test is.

A confidence interval is a range of values which probably include the true value of the variable and involves a level of probability that the result is not due to chance. A common confidence interval that is used in health care is 95%. The probability level is expressed as $p < .05$, with p equaling the level of significance. A result that is statistically

significant at this level would imply that 5 out of 100 results would be caused by chance and 95 would be as a result of the events of the research study.

Table 2 lists the values of the t-test for equality of means for adequacy category and the four birth characteristics that were measured. For birth weight as compared to adequacy of prenatal care visits, the correlation coefficient was 0.137 with a significance of 0.892. Using $p < 0.05$ as the confidence interval, this shows that there was a positive correlation between birth weight and adequacy of prenatal care visits but it was not statistically significant.

Table 2. ADEQUACY OF PRENATAL CARE VISITS AND BIRTH CHARACTERISTICS

	Correlation using T-test	Degrees of Freedom	Significance	Mean Differences
Birth Weight	0.137	38	0.892	0.0721
Gestational Age	0.500	38	0.620	0.5269
Apgar Scores at 1 Minute	1.040	38	0.305	0.5595
Apgar Scores at 5 Minutes	0.706	38	0.484	0.3214

For gestational age as compared to adequacy of prenatal care visits, the correlation coefficient was 0.500 with a significance of 0.620. Using $p < 0.05$, this shows that there was a positive correlation between gestational age and adequacy of prenatal care visits but it was not statistically significant.

For Apgar scores at 1 minute as compared to adequacy of prenatal care visits, the correlation coefficient was 1.040 with a significance of 0.305. Using $p < 0.05$, this shows that there was a positive correlation between Apgar scores at 1 minute and adequacy of prenatal care visits but it was not statistically significant.

For Apgar scores at 5 minutes as compared to adequacy of prenatal care visits, the correlation coefficient was 0.706 with a significance of 0.484. Using $p < 0.05$, this shows that there was a positive correlation between Apgar scores at 5 minutes and adequacy of prenatal care visits but it was not statistically significant.

Summary

The study population consisted of 40 subjects who fit the criteria of the study. Of those subjects, 28 women had prenatal care that was classified as an adequate amount of visits, and 12 women had care that was classified as intermediate. A positive correlation was determined between increasing birth weight and amount of prenatal care visits, increasing gestational age and amount of prenatal care visits, and increasing Apgar scores at one and five minutes and amount of prenatal care visits. However, these correlations were found to not be statistically significant using a $p < 0.05$.

CHAPTER FIVE: CONCLUSION

Summary

This study looked at the amount of prenatal care visits women thirty-five years or older received and whether or not the amount impacted the health of the babies at birth. Data on birth weight, gestational age and Apgar scores was gathered as measurements of newborn outcome. This data was compared to the amount of prenatal care visits that each woman received. According to the data gathered and the statistics that were run and analyzed, a positive correlation was found between increasing birth weight and amount of prenatal care visits, increasing gestational age and amount of prenatal care visits, and increasing Apgar scores at one and five minutes and amount of prenatal care visits. However, these correlations were found to not be statistically significant. Therefore, it cannot be implied from these results that the amount of prenatal care visits significantly influenced the birth weights, gestational ages and Apgar scores of the infants in the study population.

Implications

The findings in the study indicate that an increasing amount of prenatal care visits a woman receives is positively correlated to a higher infant birth weight, older gestational age and higher Apgar scores. However, the statistics imply that the correlation is not statistically significant. Therefore, it is possible that this positive correlation is due to chance, and it cannot be assumed that larger birth weights, increasing gestational ages and higher Apgar scores are all due to increasing amounts of prenatal care visits.

A number of previous studies on the subject concluded that low birth weight and younger gestational ages are "inversely proportional to the intensity of prenatal care

(Insler, et al., 1986), lighter babies are born to women with little or no prenatal care (Ryan, et al, 1980; Mustard & Roos, 1994), and there is an increased incidence of low Apgar scores with a declining number of prenatal visits (Insler, et al., 1986). Unlike those previous studies on the subject, a strong conclusion cannot be drawn about the relationship between prenatal care visits and birth weights, gestational ages and Apgar scores from this study. This means that in the population that was studied, it is not clear whether the amount of prenatal care visits a subject received influenced her child's birth weight, gestational age and Apgar scores, or if it was some other aspect that had an impact on the child.

Limitations

A limitation of this study is that it did not determine what is included in each prenatal visit or how long each visit is. Not all visits can be assumed to be equal in length or content. A woman who has eight prenatal visits may spend as much time with her provider and cover the same information as a woman who has ten visits.

A second limitation is the fact that it was not known whether each of the subjects had prior children and/or prior experience with prenatal care. If a subject was having her first baby and had no prior exposure to prenatal care, her experience with prenatal care may be more impactful on the outcome of her pregnancy than a women who is having her third baby and has already had prior exposure to prenatal care and has a wide base of knowledge of what to expect in her pregnancy.

Another limitation of this study involved the population that was chosen. Older women, because of their increased age, are at a higher risk for more serious complications. The increased potential for a poor outcome may not be influenced at all

by prenatal care simply because the problems are irreversible regardless of what is done after conception.

A further limitation involving the population is that the medical center the study subjects attended for prenatal and perinatal care is not a location where women with very high risk pregnancies seek care. These patients are most often referred to specialists at medical centers and clinics that are better equipped to handle complicated pregnancies and births. Therefore, the selection of the population that was chosen greatly decreases the chance of including subjects with complications that would lead to a wider range of results. This study cannot be generalized to any other population that includes subjects with known high risk for complicated pregnancies and births.

A final limitation is the size of the study. The community that was chosen for study was small and had a limited number of women of childbearing age and thus limited the number of potential subjects for study and possible birth outcomes. The results of this study can be generalized to other communities of similar sizes, but they cannot be generalized to larger communities with a greater potential for variable outcomes.

Discussion

This study was greatly influenced by the population that was chosen. Although the study population was large enough, the subjects were all low risk patients who did not have any factors that complicated their pregnancies and influenced their outcomes negatively. Even though the main implication from the study was that it appeared that a higher number of prenatal care visits was correlated with a higher birth weight, a greater gestational age and higher Apgar scores, the correlation might have been different if the

population would have included women with higher risk and/or complicated pregnancies, and a greater need for prenatal care.

Recommendations

If this study were to be done differently, it should include a study population that is more heterogeneous as far as subject characteristics and demographics. A larger group of subjects from more varied ethnic backgrounds, different socioecomomic classes, different educational backgrounds, and different communities may include women who have different prenatal practices and more varied amounts of prenatal care. This would produce an outcome that could be generalized to larger communities that include women who do not all seek prenatal care from the same providers and in the same way that women from a smaller community might. If a study included the entire state of Minnesota, instead of just a small community within Minnesota, the results would have more of an impact on communities in other states with populations as diverse as Minnesota.

A more diverse community with both low and high risk patients may involve different birth outcomes, so that babies of low birth weight, early gestational age and low Apgar scores are included in the study. This may change the outcome of the study and provide some statistically significant numbers, either supporting or rejecting the hypothesis of the study.

Another recommendation would be to look at what is included in each prenatal care visit and how long the visits last so that there are equal comparisons made between visits. For example, a visit that lasts five minutes and only includes listening to heart tones and measuring the mother's weight should not be considered equal to a visit that

lasts twenty minutes and also includes a discussion about proper nutrition and exercise in pregnancy.

Conclusions

This study looked at the amount of prenatal care visits women thirty-five years or older received and whether or not the amount of visits impacted the health of the babies at birth. The findings in the study indicate that an increasing amount of prenatal care visits a woman receives does seem to be positively correlated to a higher infant birth weight, older gestational age and higher Apgar scores. However, the numbers imply that the correlation is not statistically significant. It is not clear how big of an impact the amount of prenatal care visits has on birth outcomes. Further research with a larger and more diverse population should be done in the future to determine how strong of a connection there is between prenatal care and birth weight, gestational age and Apgar scores. In the meantime, health care providers can use the information from this study regarding the positive correlations between prenatal care and positive birth outcomes to educate their patients on the need for obtaining medical care during pregnancy.

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Appendix A

CAMBRIDGE
MEDICAL
CENTER
Allina Hospitals & Clinics

January 6, 2003

Amy Moe
17705 26th Avenue North
Plymouth, MN 55447

To Whom It May Concern:

Amy Moe is a student in the Physician's Assistant program at Augsburg College and will be participating a clinical rotation at Cambridge Medical Center in the spring of 2003. As a PA student she will be seeing patients in the clinic and will have access to patient medical records. Part of the orientation for students includes the commitment to follow the confidentiality and compliance policies of Cambridge Medical Center. After orientation, Amy will be allowed to abstract clinical information from selected records, where patients have authorized use of their records for research. If the patient has not authorized this release, Amy will not be able to use the record for her research. Amy and I spoke about her research plan. She will not be reporting patient specific information as part of her thesis. With this understanding, Amy will not require individual patient consent to review the records. If there are any concerns I would be glad to assist Amy in this process.

Sincerely,

Susan Trossen

Susan Trossen, RN
Director of Quality Improvement
Cambridge Medical Center
783-689-7807

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Appendix B

Data Collection Form

Trimester Care Initiated In _____

Amount of Prenatal Visits _____

Birth Weight of Child _____

Gestational Age of Child _____

Apgar Score of Child at 1 Minute _____

Apgar Score of Child at 5 Minutes _____

Appendix C

Definition of Adequacy of Prenatal Care

Definition	If Gestation is (weeks):	Then Number of Prenatal Visits Must Be:
Adequate	≤ 13	≥ 1
(care initiated in the first	14 to 17	≥ 2
trimester *and*)	18 to 21	≥ 3
	22 to 25	≥ 4
	26 to 29	≥ 5
	30 to 31	≥ 6
	32 to 33	≥ 7
	34 to 35	≥ 8
	≥ 36	≥ 9
Inadequate	14 to 21	0
(care initiated in the third	22 to 29	≤ 1
trimester *or*)	30 to 31	≤ 2
	32 to 33	≤ 3
	≥ 34	≤ 4
Intermediate	All combinations other than above	

Institutional Review Board
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ALLINA.
Hospitals & Clinics

February 7, 2003

Amy Moe
17705 26th Avenue North
Plymouth, MN 55447

RE: 1642-2E, The Amount of Prenatal Care Received by Women 35 Years and Older and its Effect on Birth Weight, Gestational Age and Apgar Scores at 1 and 5 Minutes

Dear Ms. Moe:

Thank you for submitting your Research Review Application dated January 6, 2003 and related study information. This study was reviewed and approved by expedited review on February 7, 2003. You are now fully approved and can start to screen and enroll participants into the above referenced study.

The IRB office has waived the protocol review fee.

Please inform the IRB immediately of any additional changes or modifications to the protocol, consent form or supporting documents prior to initiation. This includes protocol amendments, changes in the number of participants, etc. In addition all subjects enrolled must fulfill all inclusion/exclusion criteria; any exceptions must have prior approval from the IRB. You must also notify the IRB immediately of early removal of a participant (for any reason), if any participants experience serious adverse events or of events which occur at a frequency or intensity greater than that described in the approved consent form.

It is your responsibility to submit an annual Continuing Review Form to this office. Please submit this form prior to January 15, 2004 for review by the IRB. This form is available on the Allina web site at http://www.allina.com/ahs/research.nsf/page/forms. If your study has been completed or terminated prior to that date, please submit a final summary of your project in addition to the Continuing Review Form.

In any further correspondence with the IRB, please refer to the assigned study number and the name of the board that reviews this study. Please add the principal investigator's name after the study title.

If you have any questions or concerns, please call the IRB Administrative Office at (612) 775-9629.

The IRB wishes you success with your research.

Sincerely,

Ellen Stewart

Ellen Stewart
IRB Manager

An Equal Opportunity Employer

Institutional Research Board
Augsburg College
Box 107

January 21, 2003

To: Amy Moe

From: Norma C. Noonan, Chair

I am pleased to inform you that the IRB has approved your application the project: The Amount of Personal Care and Its Effects on Birth Weight, Gestational Age, and Apgar Scores

___X_ as submitted

__ __ as revised

_X_ with the following conditions:

Please use the departmental phone number, rather than a personal phone number, for inquiries about your project.

Your IRB approval number which should be noted in your written project and in any major documents alluding to the research project is as follows:

2003-3-3

I wish you success with your project. If you have any questions, you may contact me: 612-330-1198 or noonan@augsburg.edu.

c. Dawn Ludwig

Appendix F

Adequacy of Prenatal Care Visits

Trimester Care Initiated in	Amount of Prenatal Visits	Gestational Age of Baby (weeks+days)	Adequacy of Prenatal Care Visits
1	15	39+4	Adequate
1	15	40+2	Adequate
1	14	40+4	Adequate
1	14	41+1	Adequate
1	13	40+4	Adequate
1	13	40+3	Adequate
1	13	40+6	Adequate
1	13	37	Adequate
1	13	40+4	Adequate
1	13	37+6	Adequate
1	13	39+3	Adequate
1	13	42	Adequate
1	13	40+2	Adequate
1	12	38+5	Adequate
1	12	38+2	Adequate
1	12	38+4	Adequate
1	12	39+3	Adequate
1	12	39+4	Adequate
1	12	39+1	Adequate
1	12	39+5	Adequate
1	12	38+3	Adequate
1	12	38+5	Adequate
1	11	38+5	Adequate
1	10	40+1	Adequate
1	10	37+5	Adequate
1	10	37+6	Adequate
1	9	40+3	Adequate
1	3	21+4	Adequate
2	11	41+3	Intermediate
2	11	39+4	Intermediate
2	10	39+4	Intermediate
2	10	39+1	Intermediate
2	10	39+3	Intermediate
2	9	39+1	Intermediate
1	8	38	Intermediate
2	8	39	Intermediate
2	8	39+2	Intermediate
1	8	39+1	Intermediate
2	7	39+4	Intermediate
1	7	39	Intermediate

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